the boundaries of scientific knowledge. Referring to the Institute, Prof. Putnam remarks: "The scope of this foundation embraces all the sciences, and its purpose is the encouragement and patronage of research. Such an institution will have the power to render incalculable service to American archæology and ethnology, where so much needs to be done without loss of time."

WE have received the first two numbers of a series of occasional reports on the agriculture and forest culture of German East Africa, issued by the Central Government at Dar-es-Salam, and published by Carl Winter at Heidelberg. These reports, which are to be continued as occasion requires, contain the results of valuable scientific investigations by officials, dealing with such matters as the tse-tse fly, analyses of soils, climatology, &c. Extracts of reports from numerous civil and military stations are given, and accounts of exploring journeys into less-known regions of the colony.

THE current issue of the *British Medical Journal* (July 5) is a special vaccination number, and contains several interesting contributions on Jenner's life and works, and on small-pox and vaccination. Much valuable material—scientific, clinical and administrative—connected with the disease and its remedy, is described by writers of recognised authority.

MESSRS. DUCKWORTH AND CO. will publish immediately a book on "European Fungus-Flora," by Mr. George Massee, principal assistant at the Royal Herbarium, Kew. The work will be a synopsis of the European Agaricaceæ, giving the specific characteristics of 2750 European species, of which 1553 are British.

MESSRS. DAWBARN AND WARD have commenced the publication of a series of practical handbooks designed to be of service to dwellers in the country. The first book of the series, on "Outdoor Carpentry," by Mr. S. Walter Newcomb, gives brief instructions, with plans, sketches and details, for constructing rustic work of many kinds. Among the subjects of future volumes will be water-supply and distribution, sanitation and drainage, and planning gardens, grounds and outbuildings.

THE *English Illustrated Magazine* for July contains an article upon the supposed portrait of Christ on the Holy Shroud of Turin, translated from the French, and based upon Dr. Vignon's work on "Le Linceul du Christ." The article leaves the question whether the markings upon the shroud were really produced by the body of Christ undecided, but it is held that there is sufficient evidence for the belief that the image was naturally imprinted upon the shroud by the action of vapours arising from a human body. Another article in the magazine, by Mr. J. J. Ward, gives an instructive illustrated account of May-flies and related insects.

THE "Technolexicon," or technical dictionary, to be published by the Society of German Engineers, has previously been referred to in these columns. The editor, Dr. Hubert Jansen, Berlin (N.W. 7), Dorotheenstr. 49, is anxious to include in the dictionary all technical terms used by French, German and English engineers, so that the dictionary shall contain equivalent words and expressions in each of the three languages. Collaboration is invited from societies, individuals and engineering works. The editor would be glad to receive technical catalogues, price lists, hand-books, or lists of words and terms for which correct renderings cannot be found in ordinary dictionaries. The work will be so useful when ready that all who are able to contribute to its completeness should do so.

THE additions to the Zoological Society's Gardens during the past week include two White-eared Conures (*Pyrrhura leucotis*) from Brazil, presented by Lady Lindsay; two Peregrine Falcons (*Falco peregrinus*), European, presented by Dr. R. Lawton Roberts; a European Pond Tortoise (*Emys orbicularis*), European, presented by the Earl of Dudley; a Common Viper (*Vipera berus*), British, presented by Mr. E. Ball; two Snowy Egrets (*Ardea candidissima*) from America, two Vinaceous Amazons (*Chrysotis vinacea*), two Red-tailed Amazons (*Chrysotis brasiliensis*) from Brazil, seven Roofed Terrapins (*Kachuga tectum*) from India, a Black Sternothere (*Sternothoerus niger*) from West Africa, a Wrinkled Terrapin (*Chrysemys scripta rugosa*) from the West Indies, a Blue-tongued Lizard (*Tiliqua scincoides*) from Australia, a Madagascar Tree Boa (*Coratlus madagascariensis*) from Madagascar, deposited; a Proboscis Monkey (*Nasalis larvatus*) from Borneo, two White Storks (*Ciconia alba*), European, purchased.

OUR ASTRONOMICAL COLUMN.

THE PERIODICAL COMET OF TEMPEL-SWIFT (1869–1880).—This object is one of the most interesting of the somewhat numerous class of comets which at aphelion pass just outside the orbit of Jupiter and perform their revolutions in periods ranging from about 5 to 9 years. First seen by Tempel in 1869 November 27, the character of the orbit was not determined until its independent discovery by Lewis Swift in 1880 October 10. It was then found to be moving in an orbit of short period for the elements deduced by Bruhns, for the apparition of 1869 very closely resembled those obtained by Chandler for the return of 1880, and the latter pointed out the true character of the orbit early in 1880 November. Messrs. Schulhof and Bossert, of Paris, also published elements indicating a periodic time of $5\frac{1}{2}$ years.

The average period for the four returns which occurred between 1869 and 1891 was 2009 days, or 5 years and 183 days. At every alternate return, however, the comet is invisible. The perihelion is reached at a distance of about 10,000,000 miles outside the earth's orbit, and the three previously observed perihelion passages having occurred between November 6 and 18, the conditions were extremely favourable, the longitude of the comet's perihelion being 43° and the longitude of the earth on November 6 being 43°. The comet and earth were, in fact, mutually situated in or near those parts of their orbits which make the nearest approach to each other. At alternate returns such as in 1875, 1886, 1897, 1908 and 1919, the earth is on the opposite side of the sun to the comet when the latter passes through perihelion. In such circumstances the object is altogether beyond reach, for at one of these unfavourable returns it is placed nearly 200,000,000 miles from the earth, whereas under the best conditions, similar to those which prevailed during the apparition in 1880, the distance may be less than one-tenth of that mentioned.

As in 1869, 1880 and 1891, so in 1902, the comet will be very favourably visible in the autumn and winter months, and it will probably be re-detected in one of our large telescopes in about September next. The object will be by no means conspicuous, nor is it likely to display any attractive variety of aspect, but any moderately good telescope will show it as a large faint nebulosity. One of the best known of the ever-increasing group of Jovian comets, it will be sure to attract considerable attention during its forthcoming return, not so much, perhaps, on account of its visible characteristics as from the example it affords of a numerous class of bodies and from the interesting history attached to its previous appearances.

MR. TEBBUTT'S OBSERVATORY AT WINDSOR, N.S.W.—The annual report of this observatory for 1901 shows that much useful work was done last year. Measures of the positions of Venus, Ceres, Parthenope, Melpomene and Diana were made and the results forwarded to the *Astronomische Nachrichten* (Band clvi. p. 105).

Under "Comet Observations" we find that 273 determinations of the position of Comet I. 1901 were made between May 3 and June 13, 1901, and the full results were published in the *Astronomische Nachrichten* (Band clvi. p. 95 and Band clvii. p. 187). Encke's comet was fruitlessly sought on the evenings of October 2 and 8.

During twenty evenings the measures of twenty-eight double stars were made and the results published in the *Monthly Notices* R.A.S. (vol. lxi. p. 51).

The tables of meteorological observations show a temperature above, and a rainfall below the average, the year 1901 being the driest year recorded (excepting 1888) since 1862.

Many astronomers will regret the necessity for the inclusion of the following paragraph in the report, for it announces a great loss to observational astronomy generally, and especially to that of the southern hemisphere:—"In consequence of the author's advancing years, it is probable that there will be a considerable relaxation in his efforts for the year 1902."

EXTENSION OF THE KATHODE RADIATION HYPOTHESIS TO NEBULÆ.—At the meeting of the Académie des Sciences held on June 23, M. Janssen presented a note from M. Deslandres, in which the latter extends the kathode ray hypothesis, which he had already proposed in order to explain solar phenomena, to nebulæ.

The author says that the hypothesis of Arrhenius which attributes the light emitted by nebulæ to electrified particles, and also that of Nordman which attributes it to Hertzian rays gathered from space, are both wrong, for if they were true, the terrestrial atmosphere itself would, at night-time, display similar light; therefore, he adds, the light must be in the nebulæ themselves.

PERSONAL EQUATION IN THE MEASUREMENT OF SPECTROSCOPIC NEGATIVES.—In a note to the *Memorie della Società degli Spettroscopisti Italiani*, M. Hasselberg makes some interesting statements on the part that the personal equation of the observer plays in the measurement of photographic spectra. Quoting the note on this subject, by Mr. Reese, in *The Lick Observatory Bulletin*, No. 15, wherein it was demonstrated that the tendency in the case of Mr. Reese was to place the dark lines of the spectrum negative, as contrasted with the bright lines, a little too much to the right of the field of the microscope, M. Hasselberg goes on to demonstrate that in his own case the tendency is exactly opposite. Consequently, he finds that, in general, his personal equation makes his wave-lengths come out systematically less than those published by Rowland for the same lines.

The author gives three sets of measurements of metallic spectra which he has observed, compares them with the analogous values obtained by Rowland, and, after meaning the differences to eliminate accidental errors, he finds that there remains a systematic difference of ±0·007 Ångström units, and this he ascribes to purely physiological causes.

In the third table given by M. Hasselberg he compares his measurements of the lines in the tungsten spectrum: (1) when the lines are brought to the centre of the field from the left to the right, and (2) when they are brought to the centre from the right to the left, and here he finds that in the first case his values are too great, whilst in the second case they are too small.

The author concludes by pointing out that, although these errors are very small, yet they are too pronounced to be neglected, and shows that by a curious coincidence his personal error would, if introduced into the determination of radial velocities, produce a difference of exactly 1 kilometre per second from the true velocity.

APPARENT DEFORMATIONS OF THE SUN'S DISC NEAR THE HORIZON.

ALTHOUGH curious deformations of the apparent shape of the sun and moon near the horizon have been noticed from the earliest times, observations are not very frequently made, and the apparent changes of the appearances of these bodies when near the horizon cannot be said to be very commonly known. Among the earliest descriptions of this phenomenon may be mentioned one during "The strange and dangerous voyage of Captaine Thomas James, in his intended Discovery of the Northwest Passage into the South Sea," London, 1633. He states:—"I obserued the Sunne to rise like an Ouall, alongst the Horizon: I cald three or foure to see it, the better to confirme my Judgement: and we all agreed, that it was twice as long as it was broad." On March 26, 1632, James observed the same phenomenon at the time of the rising of the moon. Biot, in his "Traité élémentaire d'Astronomie physique," writes:—"C'est encore par un effet de la réfraction atmosphérique que le Soleil à l'horizon paraît ovale et aplati dans le sens vertical, même dans les temps les plus calmes et les plus sereins. Tous les points de son disque sont alors élevés par l'effet de la réfraction, mais ils le sont inégalement: les points inférieurs le sont plus que les supérieurs, parce qu'ils sont plus près de l'horizon, où la réfraction est plus forte. Le disque du Soleil doit donc alors sembler aplati, dans le sens vertical."

Among more recent papers upon this phenomenon may be mentioned one by Lieut. F. Křifka, entitled, "Refractionserscheinungen der aufgehenden Sonne" (*Meteorologische Zeitschrift*, 1891, p. 101). During the trigonometrical survey of Brno in Bohemia, Colonel von Sterneck directed attention to the remarkable shape of the rising sun, and careful observations were taken by himself with a telescope, and by Lieut. Křifka with the naked eye, until the sun rose above the horizon. Illustrations are given of the shape and colour of the sun during fifteen phases; the colour was first a deep red and gradually faded into yellow as the sun regained its globular appearance. The forms were very curious, some resembling a basin with a projecting lid; others appeared very much like the shape of a mushroom, with its stalk; later, an oval shape was assumed.

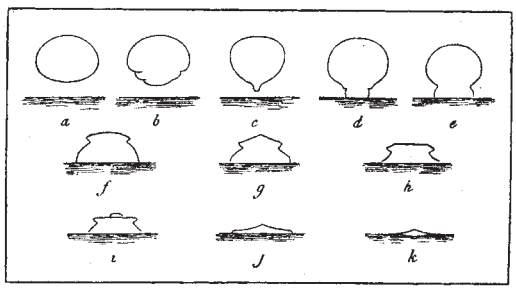

FIG. 1.

During the voyage of the Belgian Antarctic ship *Belgica*, M. H. Arctowski, a member of the scientific staff, made frequent observations of the phenomenon in question between Rio de la Plata and the Straits of Magellan, both when the sun was rising and setting, and he has communicated the results in an interesting paper published in the *Bulletin* de la Société belge d'Astronomie, accompanied by outline sketches. The description given of the phenomenon seen on November 23, 1897 (Fig. 1), off the coast of Patagonia is typical of other observations. On approaching the horizon the lower portion of the sun became flattened, and continued to become more deformed as it descended. At about 3° above the horizon there was a thin film of cloud, and the part of the sun which was still above the level of this little cloud preserved its regular shape. Gradually the lower part assumed a triangular shape, a little point or stem appeared, and became enlarged as it touched the horizon. The sketches show that all the zone comprised between the fine belt of cloud and the horizon possessed the property of deforming the sun's disc, and that in every case the cloud was the principal seat of the deformations. After the sun had set it was scarcely possible to see the cloud. The sketches very closely resemble the Bohemian illustrations already mentioned.

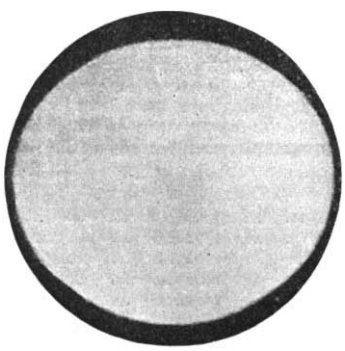

FIG. 2.

The accompanying figure (Fig. 2) is a reproduction of a photograph showing deformation of the setting sun, taken by Prof. W. Prinz, of the Royal Observatory of Belgium, at Uccle, near Brussels, and communicated to the *Memorie della Società degli Spettroscopisti Italiani*, by Prof. A. Riccò. The dark background is drawn exactly circular, in order that the deformation of the sun's disc may be seen more clearly. In this case the ratio of the vertical to the horizontal diameter is 75 : 84 mm. = 0·893.